INDUSTREX AA400 Film

INDUSTREX AA400 Film is extremely versatile, which makes it a great solution for many industrial applications. You can use it in multiple-film radiography and in single-film techniques—and with direct X-rays or with lead or other metal screens. AA400 Film incorporates T-grain emulsion technology, and is an **ASTM E 1815 Class II and EN ISO 11699-1 Class 5** film that offers high speed, high contrast and provides a fine-grain image. This film offers incredibly robust handling characteristics. It can withstand high temperatures and humidity, and it is resistant to static artifacts—so you get the image you need, whatever the conditions that you are working under.

Ideal for Aircraft Inspection, Aero-engines, Archeological Artifacts, Assemblies, Castings, Concrete, Electrical Components, Forensics, Forestry, Munitions, Bomb Disposal, Nuclear, Pipelines, Tires, Welded Fabrication.

Processing Options

AA400 Film is coated on a blue-tinted polyester support, approximately 0.2 mm (7 mil) thick. This film type can be processed manually or automatically in a range of processing cycles.

NOTE: Observe precautionary information on product labels and Material Safety Data Sheets.

Automatic processing: See CHSP-8970, *Automatic Processing of INDUSTREX Films*, for details.

Cycle	Time (Minutes)	Development Time (Seconds)	Temperature
M37 Plus Processor			
Normal	8	110	28 °C (82 °F)
Short	6	90	30.5 °C (90 °F)
M43ic Processor			
Normal	8	100	26 °C (79 °F)
Short	5	70	30 °C (86 °F)

Manual processing with rack and tank: See CHSP-8971, *Manual Processing of INDUSTREX Films*, for details.

Temperature	Time (Minutes)	Acetic Acid Stop Bath	Fixer	Wash
20 °C (68 °F)	5	30-60 seconds (Continuous moderate agitation)	3-6 mins or twice the time to clear film (Vigorous agitation for 15 seconds, then 5 seconds every 30 seconds)	10-30 mins in running water (8 volume changes per hour)
22 °C (72 °F)	4			
24 °C (75 °F)	3			
26 °C (79 °F)	2			

Film Types and Package Formats

The table provides the film notch pattern, types, and suffixes, with more details below:

AA400 Film Edge Notch (Interleaved (INT) and Non-Interleaved (NIF) Sheets only)		Sheets		Rolls	
Double-triangular		Interleaved	Suffix 5	Ready Pack	Suffix 381
		Non-Interleaved	Suffix 1	Lead Pack	Suffix 382
		Pb Contactpak	Suffix 7	NIF Bulk	Suffix 359
		READY-PACK II	Suffix 2		

NOTES:

- The INDUSTREX Films that are packaged in sheets are identifiable by an edge-mark/notch or embossing; **the sheets are uniquely marked for easy identification in the darkroom and after processing**. For more details, see CHSP-8984, *INDUSTREX Films: Film Types and Features*.
- Not all packaging formats are available for all INDUSTREX Films.

Sheet—Interleaved (INT) (suffix 5)

Each film is individually enclosed in a folder for extra protection during handling. For most sizes, the unit pack is 100 (2 x 50) sheets. Interleaving the film also helps prevent film sheets from sticking together if the film box has been opened in a hot or humid environment. The interleaving paper is often used to store the processed radiographs and to record relevant information such as exposure date, exposure conditions, and specimen number.

Sheet—Non-Interleaved (NIF) (suffix 1)

Supplied in packs of 100 sheets.

Sheet—Pb Contactpak (suffix 7)

This pack consists of a film placed between two 27 µm thick lead screens sealed in a light-tight, water-resistant, flexible package. A vacuum inside the pack provides superb film/screen contact. The package has a butt edge, which is invaluable for accurate positioning in difficult situations where the image needs to fall right up to the edge of the pack. Clean to use, water- and oil-resistant, and available for exposure immediately. Since the lead screens are only used once, optimal results are guaranteed.

Sheet—READY-PACK II (suffix 2)

These films are individually vacuum sealed in light-tight, water-resistant, flexible packages. The package has a butt edge, which is invaluable for accurate positioning in difficult situations where the image needs to fall right up to the edge of the pack.

Roll—Ready Pack (suffix 381)

The film is supplied in a long, light-tight roll placed between two polyethelene layers. The rolls are 90 m long in a variety of widths. The film is provided in a dispenser box and is cut to length by the user in a darkroom. A length indication in metres is printed in black on the packaging sleeve so as to be highly legible in the darkroom.

Roll—Lead Pack (suffix 382)

The film is placed between two 27 µm thick lead screens inside a long, light-tight paper and polyethelene sleeve. The rolls are 90 m long and are cut to length by the user in a darkroom. A length indication in metres is printed in black on the packaging sleeve so as to be highly legible in the darkroom. Since the lead screens are only used once, optimal results are guaranteed.

Roll—NIF Bulk (suffix 359)

The film is supplied on a cardboard core in rolls of 150 m long in various widths: 60 mm, 70 mm, 90 mm, and 100 mm. NIF bulk rolls 70 mm in width are also available in the 305 metre lengths. The film must be loaded into a cassette in a darkroom.

Lead Screens

The 27 µm lead foil features a protective overcoat, which prevents human contact with the lead, protects the film from potential "lead smudge" artifacts, and provides static protection due to the separation of the film and screens.

Storage

Unexposed:		10–24 °C (50–75 °F) Do not refrigerate or freeze as this can cause condensation to occur.
		30–50 % RH
		Protect from heat and radioactive sources. Film is to be properly shielded from x-rays, gamma rays, or penetrating radiation.
Expiration:		Use film before the expiration date, which is identified on each film box. Also: • Rotate inventory to use the older film first. • Avoid storing unexposed film boxes for extended periods.
Do not reuse:		Do not reuse. Film is a single-use device.
Exposed:	Keep cool, dry, and properly shielded from penetrating radiation. Process as soon as possible.	
Processed:	16–27 °C (60–80 °F), 30–50 % RH	

For more information, if needed:

- ASTM E1254 gives details of storage conditions.
- For processed films, ISO 18911 and ISO 18902 provide recommended storage conditions and specifications for their enclosure materials.

Film Handling

- Hands must be clean, dry and free of lotions.
- Handle film carefully by the edges to avoid physical strains such as pressure, creasing, or buckling. Pressure to the film's surface can cause plus-density marks to develop. To avoid handling artifacts, carry a single sheet of film by the two opposite corners, or gently bend the film, but avoid pressing the areas of the film surface together.
- Avoid luminous watches, cell phone and darkroom light leaks.

Safelight Filter

The darkroom must have suitable safelight illumination.

Use a Red Safelight Filter, such as GBX-2, with a frosted 15-watt bulb or a LED Safelight (660 nm peak) located at least 1.22 m (48 in.) from the film.

NOTE: Other safelights filters that block radiation at 550 nm and shorter wavelengths are also suitable.

Relative Exposure for Various Energy Levels: 8 minutes, 26 °C (79 °F)

INDUSTREX Films	Relative Exposure for Various Energy Levels			
	ISO 120 kV*	EN 220 kV√	Iridium¥	Cobalt‡
DR50	9.0	7.2	9.0	9.0
M100	4.1	4.2	5.4	6.3
MX125	2.9	2.8	3.1	3.3
T200	1.6	1.7	1.9	1.9
AA400	1.0	1.0	1.0	1.0
HS800	—	0.5	—	—

*In accordance with ISO 7004 standard, without lead screens
√In accordance with ISO 7004 standard, EN ISO 11699-1 lead screens
¥8 mm Copper filtration. 100/200 µm lead screens
‡100/200 lead screens

R-Factors – INDUSTREX AA400 Films

Reference the table to determine the correct exposure, based on desired density:

Desired Densities:	2		2.5		3		3.5
Selenium	0.8		1.2		1.6		2.0
Iridium	0.8		1.1		1.5		1.9
Cobalt	1.2		1.8		2.4		2.9

Characteristic Curves – INDUSTREX AA400 Films

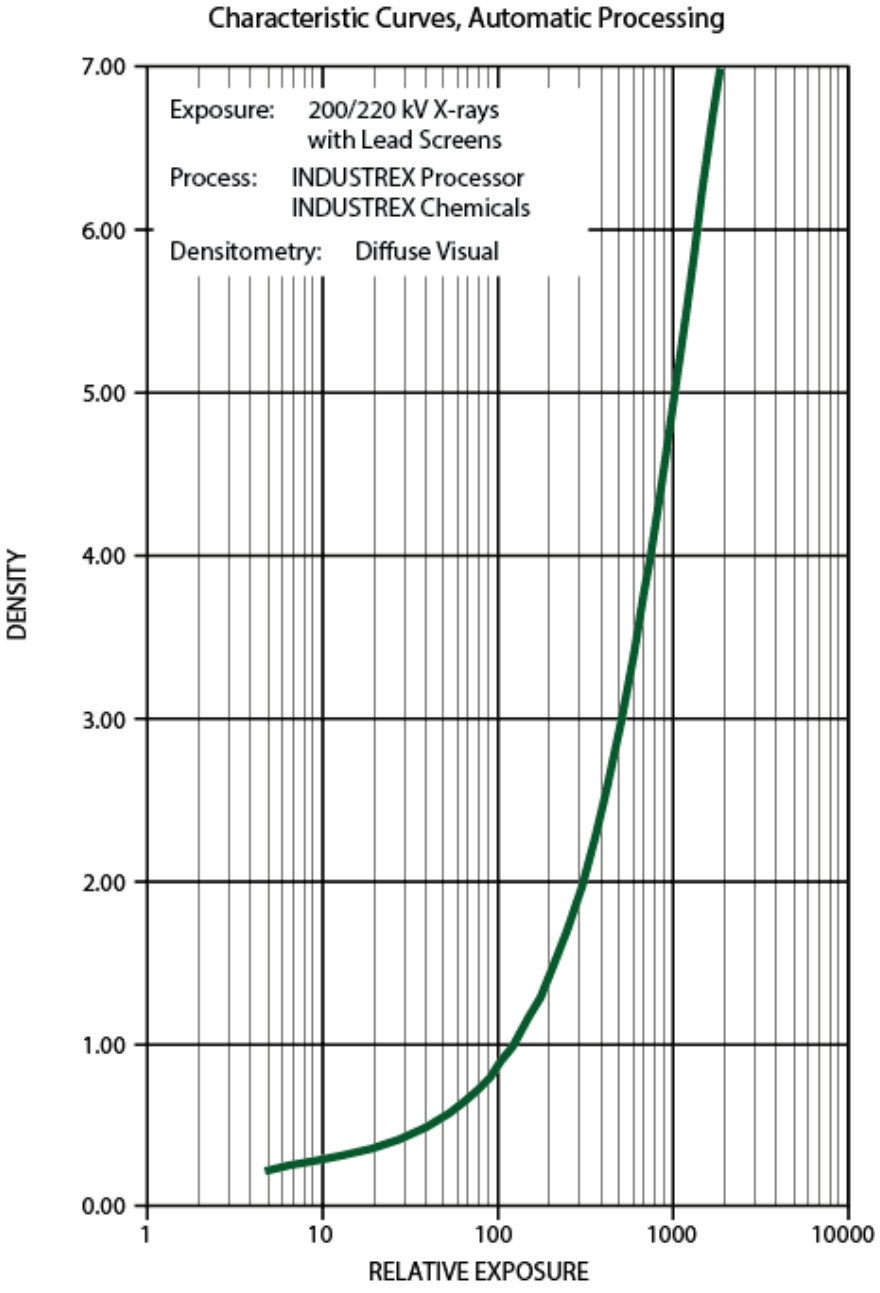
Film characteristic curves can be used to:

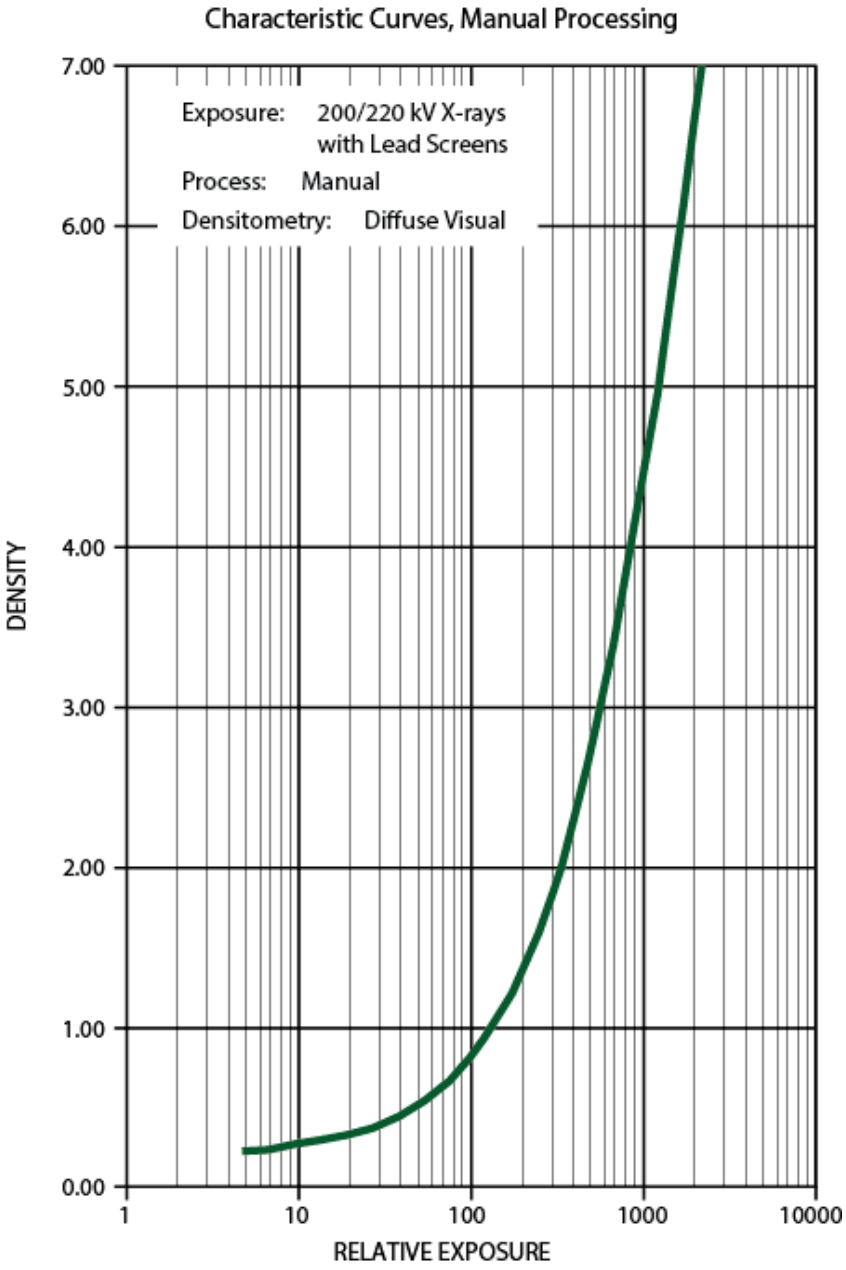
- Adjust the X-ray exposure that is used to produce a radiograph with a certain optical density to an exposure that will produce a second radiograph of higher optical density.
- Relate the X-ray exposure produced with one film to the exposure needed to produce a radiograph of the same density with another radiographic film.

When using a gamma source, you can use R-Factors (see the table above) to determine the correct exposure.

Film Contrast is the slope, or steepness of the characteristic curve. For industrial X-ray films, the contrast increases throughout the useful density range.

- Automatic Processing: 8 minutes, 26 °C (79 °F)
- Manual Processing: 5 minutes, 20 °C (68 °F)





NOTE: While the sensitometric data in this publication are typical of production coatings, they do not represent standards that must be met by Carestream. Varying storage, exposure, and processing conditions will affect results. The company reserves the right to change and improve product characteristics at any time. The contents of this publication are subject to change without notice.

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Rev 2: July 2020 – Minor edits for consistency with other NDT film TIs.

Rev A (PLI): Rev 2 is released into PLI. Going forward, releases will follow PLI (letter) revisioning.